

CLAIMS

What is claimed is:

- 1 1. A method comprising:
 - 2 depositing a no-flow underfill material in a component mounting area of a
 - 3 substrate, the component mounting area comprising a plurality of pads;
 - 4 placing a component on the component mounting area, such that terminals of
 - 5 the component are aligned with corresponding pads and substantially enveloped in
 - 6 the underfill material;
 - 7 applying suitable pressure to cause the terminals to physically contact the
 - 8 pads; and
 - 9 applying suitable heat to harden the underfill material.
- 1 2. The method recited in claim 1, wherein, in depositing, the underfill material
- 2 is deposited over the pads.
- 1 3. The method recited in claim 1, wherein, in depositing, the underfill material
- 2 comprises a filler material to reduce the coefficient of thermal expansion.
- 1 4. The method recited in claim 1, wherein, in depositing, the underfill material
- 2 comprises a filler material to increase the modulus of elasticity.
- 1 5. The method recited in claim 1, wherein, in depositing, the underfill material
- 2 comprises a filler material to increase the viscosity.
- 1 6. The method recited in claim 1, wherein, in depositing, the underfill material
- 2 comprises a filler material selected from the group comprising silica, silicon oxide,
- 3 silicon dioxide, silicon nitride, aluminum oxide, and aluminum nitride.

1 7. The method recited in claim 6, wherein, in depositing, the filler material is in
2 the range of 0% to 80%, by weight, of the underfill material.

1 8. The method recited in claim 1, wherein, in depositing, the underfill material
2 comprises filler particles having a size in the range of 0.05 microns to 40 microns.

1 9. The method recited in claim 8, wherein, in depositing, the filler particles are
2 substantially spherical.

1 10. The method recited in claim 1, wherein, in depositing, the underfill material
2 comprises a resin selected from the group comprising an epoxy resin, a siloxirane
3 resin, a superoxirane resin, a polybenzoxazine resin, a benzocyclobutane resin, or a
4 mixture thereof.

1 11. The method recited in claim 1, wherein, in depositing, the underfill material
2 comprises a fluxing agent.

1 12. The method recited in claim 11, wherein, in depositing, the fluxing agent is
2 selected from the group comprising an organic carboxylic acid, a polymeric fluxing
3 agent that has one or more carboxylic acid groups, an organic compound that
4 contains one or more hydroxyl groups, or a mixture thereof.

1 13. The method recited in claim 1, wherein the pads are pre-coated with solder,
2 and wherein, in applying suitable heat, the terminals become attached to the pads
3 through the solder.

1 14. The method recited in claim 1, wherein the terminals are pre-coated with
2 solder, and wherein, in applying suitable heat, the terminals become attached to the
3 pads through the solder.

- 1 15. The method recited in claim 1, wherein the terminals and the pads are pre-
2 coated with solder, and wherein, in applying suitable heat, the terminals become
3 attached to the pads through the solder.
- 1 16. The method recited in claim 1, wherein the operations of applying suitable
2 pressure and suitable heat are performed substantially concurrently.
- 1 17. The method recited in claim 16, wherein the operations of applying suitable
2 pressure and suitable heat are performed by apparatus from the group comprising a
3 thermocompression bonder and an ultrasonic bonder.
- 1 18. The method recited in claim 1, wherein the operation of applying suitable
2 pressure is performed by a die placement tool.
- 1 19. The method recited in claim 18, wherein the pads are pre-coated with solder,
2 and wherein the method further comprises:
3 pre-attaching the terminals to the pads by applying suitable heat using the
4 die placement tool.
- 1 20. The method recited in claim 18, wherein the terminals are pre-coated with
2 solder, and wherein the method further comprises:
3 pre-attaching the terminals to the pads by applying suitable heat using the
4 die placement tool.
- 1 21. The method recited in claim 18, wherein the operation of applying suitable
2 heat is performed by solder reflow apparatus.
- 1 22. A component package fabricated by:
2 depositing a no-flow underfill material in a component mounting area of a
3 substrate, the component mounting area comprising a plurality of pads;

- 4 placing a component on the component mounting area, such that terminals of
- 5 the component are aligned with corresponding pads and substantially enveloped in
- 6 the underfill material;
- 7 applying suitable pressure to cause the terminals to physically contact the
- 8 pads; and
- 9 applying suitable heat to harden the underfill material.

- 1 23. The component package recited in claim 22 and fabricated such that the
- 2 operations of applying suitable pressure and suitable heat are performed
- 3 substantially concurrently by apparatus from the group comprising a
- 4 thermocompression bonder, an ultrasonic bonder, and a component placement tool.
- 1 24. The component package recited in claim 22 and fabricated such that the pads
- 2 are pre-coated with solder, and wherein, in applying suitable heat, the terminals
- 3 become attached to the pads through the solder.
- 1 25. The component package recited in claim 22 and fabricated such that the
- 2 terminals are pre-coated with solder, and wherein, in applying suitable heat, the
- 3 terminals become attached to the pads through the solder.
- 1 26. The component package recited in claim 22, wherein the underfill material
- 2 comprises a filler material selected from the group comprising silica, silicon oxide,
- 3 silicon dioxide, silicon nitride, aluminum oxide, and aluminum nitride.
- 1 27. An electronic assembly comprising at least one integrated circuit (IC)
- 2 package fabricated by:
 - 3 depositing a no-flow underfill material in an IC mounting area of a substrate,
 - 4 the IC mounting area comprising a plurality of pads;

5 placing an IC on the IC mounting area, such that terminals of the IC are
6 aligned with corresponding pads and substantially enveloped in the underfill
7 material;

8 applying suitable pressure to cause the terminals to physically contact the
9 pads; and

10 applying suitable heat to harden the underfill material.

1 28. The electronic assembly recited in claim 27 and fabricated such that the
2 operations of applying suitable pressure and suitable heat are performed
3 substantially concurrently by apparatus from the group comprising a
4 thermocompression bonder, an ultrasonic bonder, and a component placement tool.

1 29. The electronic assembly recited in claim 27, wherein the underfill material
2 comprises a filler material selected from the group comprising silica, silicon oxide,
3 silicon dioxide, silicon nitride, aluminum oxide, and aluminum nitride.

1 30. An electronic system comprising:
2 a bus coupling components in the electronic system;
3 a display coupled to the bus;
4 external memory coupled to the bus; and
5 a processor coupled to the bus and having an electronic assembly including
6 at least one integrated circuit (IC) package fabricated by:

7 depositing a no-flow underfill material in an integrated circuit (IC)
8 mounting area of a substrate, the IC mounting area comprising a plurality of
9 pads;

10 placing an IC on the IC mounting area, such that terminals of the IC
11 are aligned with corresponding pads and substantially enveloped in the
12 underfill material;

13 applying suitable pressure to cause the terminals to physically
14 contact the pads; and

15 applying suitable heat to harden the underfill material.

- 1 31. The electronic system recited in claim 30 and fabricated such that the
- 2 operations of applying suitable pressure and suitable heat are performed
- 3 substantially concurrently by apparatus from the group comprising a
- 4 thermocompression bonder, an ultrasonic bonder, and a component placement tool.

- 1 32. The electronic system recited in claim 30, wherein the underfill material
- 2 comprises a filler material selected from the group comprising silica, silicon oxide,
- 3 silicon dioxide, silicon nitride, aluminum oxide, and aluminum nitride.

TOP SECRET - DRAFT - ATTORNEY USE ONLY